Stanford U.

PROGRESS REPORT

for the

National Aeronautics and Space Administration

NASA Grant NgR 05-020-73

for the period
June 30 through December 31, 1965

R. E. Kalman, Investigator

1. Personnel

No change since the last progress report.

2. Research

(a) Stability theory. Research on the problems discussed in the last progress report has been brought to a certain level of completion, in the sense that the immediate questions have been answered, while the long-range problems remain much as they were.

Brockett's theorems have been put into a unified language by defining a passive nonlinear system and showing

that Brockett's conditions are precisely those which allow one to prove this property. Any further extension of this point of view will require high-powered functional analysis, which is not contemplated before 1967.

The problem of characterizing optimal control problems, undertaken in collaboration with B. L. Ho (doctoral student supported by IBM) has been completed. Ho's dissertation has led to an important new scheme for system identification (see below).

(b) Stochastic optimization. Only minor activity pending completion of papers dealing with the items under (a).

3. Future plans

As already indicated in the proposal for continuation of this grant, we are very much interested in exploiting the method of B. L. Ho (HO and KALMAN, 1965) for the identification of linear dynamical systems. Discussions with Dr. E. C. Stewart (Ames Research Center) indicate the possibility of applying this method to problems involving the human operator. There is also a good and current reason for doing so: classical techniques in this area are increasingly inadequate, and no fundamental theoretical work has been done since the 1940's.

As of now, it is planned to have Dr. U. Passy work on this problem as a postdoctoral fellow. This work will not begin until the summer, however.

4. References

B. L. Ho and R. E. Kalman 1965, "Effective construction of linear state-variable models from input/output data", Proc. 3rd Allerton Conference*, pp. 449-459.

*This does not constitute regular publication. A revised version of the paper is to appear in REGELUNGSTECHNIK, and a comprehensive treatise of the whole problem is planned for the SIAM Journal on Control.